W Claim:

1. An optically pumped surface-emitting semiconductor laser device comprising:

a radiation-generating quantum well structure formed by a semi-conductor layer sequence, said semi-conductor layer sequence being expitaxially and successively grown on a common substrate; and

a pump radiation source with a radiation region for optically pumping the radiation generating quantum well structure, said pump radiation source including an edge-emitting semiconductor structure, said edge-emitting semiconductor structure being formed by the semi-conductor layer sequence being expitaxially and successively grown on the common substrate.

2. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein the radiation generating quantum well structure and the pump radiation source are being arranged side-by-side such that:

the radiation-generating quantum well structure and the radiation-emitting region of the pump radiation source lie at a same height above the common substrate; and

a pump radiation from the pump radiation source is being laterally coupled into the radiation generating quantum well structure during operation of the optically pumped surface emitting semiconductor laser device.

3. An optically pumped surface-emitting semiconductor laser device according to claim 2, wherein:

the radiation-generating quantum well structure is being surrounded by the edge-emitting semiconductor structure; and

the pump radiation source is a gain-guided radiation-emitting active region being formed on a basis of a current injection path on a surface of the edge-emitting semiconductor laser structure.

4. An optically pumped surface-emitting semiconductor laser device according to claim 2, wherein:

the radiation-generating quantum well structure is being surrounded by the edge-emitting semiconductor structure; and

the pump radiation source is an index-guided radiation-emitting active region that is being defined on a basis of a current injection path on a surface of the edge emitting semiconductor structure in combination with trenches in the edge - emitting semiconductor structure formed along a current injection path.

5. An optically pumped surface-emitting semiconductor laser device according to claim 4 , wherein ends of current injection paths facing toward the radiation-generating quantum well structure include a spacing of 10 µm - 50 µm therefrom.

6. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein the pump radiation source includes two pump radiation sources being arranged at opposite sides of the radiation generating quantum well

structure, said two pump radiation sources for emitting pump radiation into the radiation generating quantum well structure during operation.

7. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein the pump radiation source includes a plurality of pump radiation sources being arranged in a star-like manner around the radiation generating quantum well structure, said plurality of pump radiation sources for emitting pump radiation into the radiation generating quantum well structure during operation.

8. An optically pumped surface-emitting semiconductor laser device according to claim 6, wherein the two pump radiation sources together form a laser structure for an optical pumping with laser emission.

9. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein the pump radiation source include a ring laser.

10. An optically pumped surface-emitting semiconductor laser device according to claim 9, wherein the radiation generating quantum well structure is arranged within a resonator of the ring laser.

11. An optically pumped surface-emitting semiconductor laser device according to 10, wherein the resonator of the ring laser is formed by an annularly closed waveguide.

12. An optically pumped surface-emitting semiconductor laser device according to claim 9, wherein the edge-emitting semiconductor structure is being surrounded by a medium with a refractive index being less than a refractive index of the edge-emitting semiconductor structure.

13. An optically pumped surface-emitting Semiconductor laser device according to claim 9, wherein the edge-emitting semiconductor structure is surrounded by at least one of a gaseous medium and a dielectric.

14. An optically pumped surface-emitting semiconductor laser device according to claim 9, wherein the edge-emitting semiconductor structure is being formed as a cylindrical body with one of a circular and annular cross section.

15. An optically pumped surface-emitting Semiconductor laser device according to claim 9, wherein the edge-emitting semiconductor structure is being formed as a prismatic body with a cross section in a form of one of a polygon and a polygonal ring.

16. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein the edge-emitting semiconductor structure includes an active layer embedded between a first waveguide layer and a second waveguide layer, said first wave guide layer and said second waveguide layer being embedded between a first cladding layer and a second cladding layer.

17. An optically pumped surface-emitting semiconductor laser device according to claim 16, wherein:

a boundary surface between the edge-emitting semiconductor structure and the radiation generating quantum well structure is partially reflective.

18. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein:

the edge-emitting semiconductor structure includes a plurality of active layers that are being connected in series with tunnel transitions, and

the radiation-generating quantum well structure includes a plurality of quantum well groups that respectively lie at a same height above the common substrate as an active layer of the edge-emitting semiconductor structure.

19. An optically pumped surface-emitting semiconductor laser device according to claim 1, wherein:

the radiation-emitting quantum well structure and the pump radiation source are arranged above one another on the common substrate; and

the radiation-emitting quantum well structure is being optically coupled to the edge-emitting semiconductor structure, so that a pump radiation is being guided into the radiation-emitting quantum well structure during operation of the optically pumped surface emitting semiconductor laser device.

20. An optically pumped surface-emitting semiconductor laser device according to claim 19, wherein :

the edge-emitting semiconductor structure includes a first waveguide layer and a second waveguide layer and an active layer, said active layer arranged between the first waveguide layer and the second waveguide layer; and,

the quantum well structure being epitaxially grown on the second waveguide layer, covers only a sub-region of the edge-emitting semiconductor structure and is being optically coupled thereto, so that a part of the pump radiation generated in the edge-emitting semiconductor structure is being guided into the quantum well structure.

21. An optically pumped surface-emitting semiconductor laser device according to claim 20, wherein:

the pump radiation source is a gain-guided radiation-emitting active region being formed in the edge-emitting semiconductor structure via a correspondingly structured current injection path on a surface of the second waveguide layer.

22. An optically pumped surface-emitting Semiconductor laser device according to claim 21, wherein:

the pump radiation source is being formed in combination with correspondingly etched trenches in the second waveguide layer.

23. An optically pumped surface-emitting Semiconductor laser device according to claim 20, wherein a refractive index of the second waveguide layer is higher than a refractive index of the first waveguide layer.

24. An optically pumped surface-emitting semiconductor laser device according to claim 20, wherein the active layer is being asymmetrically placed in the waveguide formed by the first waveguide layer and the second waveguide layer.

25. An optically pumped surface-emitting semiconductor laser device according to claim 2 , wherein:

the common substrate is being composed of a material being transmissive for a laser beam generated in the optically pumped surface emitting semiconductor laser device; and

a resonator mirror layer with an optimally substantially high reflection coefficient is being applied on a side of the radiation generating quantum well structure facing away from the common substrate.

26. A method for manufacturing an optically pumped surface-emitting semiconductor laser device comprising:

applying a surface-emitting semiconductor laser layer sequence onto a common substrate, said surface-emitting semiconductor layer sequence having a quantum well structure;

removing the surface-emitting semiconductor laser layer sequence outside an intended laser region and exposing an exposed region;

applying an edge-emitting semiconductor layer sequence onto the exposed region over the common substrate, said exposed region being exposed via said removing step, said exposed region being suitable for transmitting pump radiation into the quantum well structure; and

forming a current injection path in the edge-emitting semiconductor layer sequence.

27. A method for manufacturing an optically pumped surface-emitting according to claim 26, further comprising the steps of:

performing said first applying step via:

applying a buffer layer onto the common substrate;

applying a first confinement layer onto the buffer layer;

applying the quantum well structure suited for a surface-emitting semiconductor laser onto the first confinement layer; and

applying a second confinement layer onto the quantum well structure;

performing said removing step via;

removing the first confinement layer and the second confinement layer and the quantum well structure; and

partially removing the buffer layer outside the intended laser region;

performing said second applying step via;

successively applying a first cladding layer, a first waveguide layer, an active layer, a second waveguide layer and a second cladding layer onto an uncovered region of the buffer layer, wherein a respective layer thickness is designed such that a pump radiation generated in the active layer proceeds into the quantum well structure.

28. A method for manufacturing an optically pumped surface-emitting semiconductor laser device comprising:

applying an edge-emitting semiconductor layer sequence onto a substrate;

further applying a surface-emitting semiconductor laser layer sequence having a quantum well structure onto the edge-emitting semiconductor layer sequence;

removing the surface-emitting semiconductor laser layer sequence outside an intended laser region; and

forming at least one current injection path in the edge-emitting semiconductor layer sequence.

29. A method according to claim 28, further comprising the steps of:

performing said applying step via:

applying a buffer layer onto the substrate;

successively applying a first waveguide layer, an active layer and a second waveguide layer onto the buffer layer;

performing said further applying step via:

applying a first confinement layer onto the second waveguide layer;

applying the quantum well structure suited for a surface-emitting semiconductor laser onto the first confinement layer;

applying a second confinement layer onto the quantum well structure;

performing said removing step via:

removing the first confinement layer and the second confinement layer and the quantum well structure; and

partially removing the second waveguide layer outside the intended surface-emitting laser region.